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ABSTRACT

In an effort to improve the science education program in the Washington School District (Phoenix, Arizona) the school system focused its efforts in the 1983-84 school year on the development of an activity oriented laboratory science program for grades 4-6. This document describes the plan for implementing that program. The implementation strategies focused on seven administrative standard operational procedures. These include: (1) providing laboratory facilities for all students in grades 4-6; (2) staffing of science classes with trained science teachers; (3) following a science scope and sequence; (4) following science assessment and pacing guides; (5) developing and using a teacher-developed district laboratory handbook; (6) monitoring of pupil progress through basic skills tests; and (7) devoting a minimum of 300 minutes per six-day schedule to science instruction, including a minimum of 50 percent of that time devoted to hands-on laboratory activities. Thirteen appendices are included to provide clarity and background information to statements made in this report. (TW)

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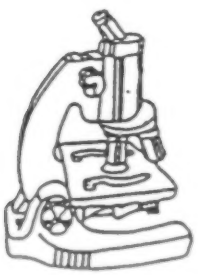
ED285724

WASHINGTON SCHOOL DISTRICT

IMPLEMENTATION OF AN ACTIVITY ORIENTED LABORATORY SCIENCE PROGRAM FOR GRADES 4, 5, AND 6



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1985-86

SE 048 313

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INTRODUCTION

"Scientific literacy is at its lowest ebb," "there is a crisis in American science education," and numerous other negative phrases are easily found in federal reports, professional journals, and popular public media. This serious problem which has been developing during the sixties and the seventies is the focus of a science improvement program of the Washington School District. To provide excellence in science education, the Washington School District Governing Board has taken direct action philosophically and financially to improve the science education of the intermediate grade students in the Washington School District.

Since the early sixties, the Washington School District has implemented the SCIIS Program in grades K-3. SCIIS is a student activity science program with a problem-solving base and provides excellent preparation for a lab-oriented science program. In grades 7 and 8, science teachers with laboratory facilities for science instruction is a standard. The science programs in the intermediate grades — 4, 5, and 6 — however, have been taught by homeroom teachers using standard classrooms and text. The reorganization from K-8 schools to K-6 and 7-8 schools, the national focus on the need to improve science education, and support by the Governing Board provided an excellent opportunity to develop and implement the intermediate science program to a level of implementation already enjoyed by other basic subjects.

The Washington School District, after examining all areas critical to instruction, was able to take advantage of existing strengths and concentrate on areas which needed to be improved. All schools with K-6 students adjusted their existing procedures, staff, and facilities to accommodate a lab-oriented science program taught by teachers specifically trained to teach intermediate science. The results of this program offer students an opportunity to study science in a lab-oriented program throughout their education in Washington School District.

This support includes: (1) laboratory facilities; (2) trained science teachers; (3) an ongoing science in-service program designed to maintain quality science teachers; (4) curriculum scope and sequence which list specific objectives that pupils are expected to master and include a Science Assessment and Pacing Guide; (5) a set of laboratory activities which are designed to provide students with "hands-on" lab experience; and (6) a criterion referenced Basic Skills Test to evaluate student progress.

DEMOGRAPHICS

The Washington School District encompasses 44 square miles in northwest Phoenix. The district contains twenty-five K-6 schools, five junior high schools, and two K-8 schools. The district has a staff of 1,170 serving 20,822 students. This science program meets the needs of 2,160 fourth, 2,165 fifth, and 2,170 sixth grade students.

District Goal 1983-84

To improve the science education in the intermediate grades of the Washington School District, the Governing Board mandated by district goal that the district will *improve health and science instruction*.

Administrative Standard Operational Procedures

To implement the goal, the district developed the following standard operating procedures for the science programs in grades 4-6:

A. Laboratory facilities will be provided for all 4-6 students.

B. Science classes will be staffed by trained science teachers.

C. A Science Scope and Sequence shall be followed.

D. Science Assessment and Pacing Guides will be followed.

E. A teacher-developed district laboratory handbook will direct expected laboratory outcomes.

F. Basic Skills Tests will monitor pupil progress.

G. A minimum of 300 minutes per six day schedule will be followed with a minimum of 50 percent devoted to hands-on laboratory activities.

Reference Appendix #1

IMPLEMENTATION

To implement the district goal and the standard operating procedures, each of the following areas were examined and procedures were put into effect to improve the grades 4-6 science curriculum, staff, and facilities.

A. FACILITIES

1. Before Implementation

   Typical science was taught in a standard classroom with no special consideration given to science instruction. Some schools had developed intermediate science rooms because of specific teacher instructional expertise in hands-on activities with children.

2. After Implementation

   Each school contains a minimum of one science laboratory. Each laboratory must have at least three sink-laboratory stations and a built-in teacher demonstration table. All stations and the teacher demonstration tables have gas and electric outlets. Additional storage cabinets are provided. This new emphasis in grades 4-6 was facilitated by the district's change from a K-8 system to a K-6 and 7-8 system. This freed the former 7-8 science labs to be used for intermediate grade science.

B. STAFFING

1. Before Implementation

   Science was taught by the homeroom teacher. Typically the homeroom teacher would have six to nine semester hours in science preparation and would teach science as a reading class. Some schools had well-trained science teachers and these teachers would provide an excellent student-oriented science program to their students. This resulted in an inequity of instruction between classrooms and grade levels.

2. After Implementation

   Each school selected its most capable science teacher(s) to teach all of the 4-6 science. Large schools could choose two or three teachers which would result in one science teacher per grade level. Each teacher must use the science laboratory for at least 50 percent of the time. Response to a science teacher questionnaire of May, 1985, showed that the average 4-6 science teacher had 32.1 semester hours of college work in science. This is the equivalent of a teaching major in Arizona. The Washington School District has maintained a constant science inservice program which has resulted in a large number of highly qualified teachers.

   A departmentalized staff provides for this expertise to be available to all students.

C. SCOPE AND SEQUENCE

1. Before Implementation

   The Scope and Sequence served as a general reference which did not provide provisions for monitoring and pacing.

2. After Implementation

   Through the use of the *Science Assessment and Pacing Guide* for content and laboratory science the areas of emphasis and instructional goals have been identified, thus providing a balance in the curriculum between content and student activities.

D. SCIENCE ASSESSMENT AND PACING GUIDES

1. Before Implementation

   Each teacher selected the units of study he or she wished to pursue. Sometimes this resulted in a fragmented curriculum with extended amounts of time spent on favorite units with other areas being reduced or left out.

2. After implementation

   The *Science Curriculum Assessment and Pacing Guide* lists the objectives the student is expected to master. Each teacher initials the objective after completion, and the principal monitors the teachers' progress quarterly. The purpose of the *Science Curriculum Assessment and Pacing Guide* is to, (1) provide a method for principals to monitor the science program, (2) provide guidance for successful Basic Skills Testing mastery, (3) provide a uniform science curriculum for all students in grades 4-6 with expected outcomes for all objectives. *Reference Appendix #2.*

   The *Laboratory Science Curriculum Assessment and Pacing Guide* lists the laboratory activities to be completed at each grade level. The student laboratory manual contains teacher direction and student laboratory sheets for 70 activities per grade level. *Reference Appendix #3.*

E. STUDENT LABORATORY MANUAL

1. Before implementation

   The development and use of student laboratory manuals did not exist. Activities were left to the discretion of the teachers. The only activities which were available districtwide were those found in the textbook. The science program published by Silver Burdett is the adopted text.

2. After implementation

   A committee of teachers worked during the fall of 1983 to develop a selection of laboratory activities which have become the minimal laboratory standard for grades 4-6. The activities are designed to reinforce concepts which are found in the district's *Science Assessment and Pacing Guide*. These activities are monitored by the use of the *Science Curriculum Laboratory Assessment and Pacing Guide*. The number of activities selected provide ample time for the teacher to expand concepts and spend additional time on areas of teacher/student interest. During the summer of 1985, a committee of teachers revised the student laboratory manual using suggestions of their colleagues for improvement. The laboratory manual still contains 70 required activities per grade level requiring approximately 85 teaching periods to complete. *Reference Appendix #4.*

   Included in the set of laboratory activities are teaching suggestions which encourage the development of problem solving skills and the use of supplemental activities from Elementary Science Study (ESS), Project Learning Tree, and other student activity-oriented programs.

   To support the *HBJ Health* text and laboratory activities, the district has implemented the *Health Activities Project* (HAP), a science-oriented health activities program. *Reference Appendix #5.*

   Outdoor Education is encouraged. A 60 page district-developed *Environmental Education Guide* is available describing techniques and procedures for resident camping experiences. Each school has the option of using Lake Pleasant for a three-day, two-night residential camping experience. The curriculum consists of activities from *Outdoor Biological Instructional Strategies* (OBIS), *Project Learning Tree*, and *Project Wild*.

   A science teacher questionnaire in May, 1985 indicated that the average number of laboratory experiences before the district goal was 25. After implementation the number rose to 58.9 per grade level, an increase of 133 percent per grade level. Eighty-seven percent of the teachers stated that the quality of their programs improved with the district emphasis in science. *Reference Appendix #6.*

F. SCHOOL AND PROGRAM REVIEWS

Each school's science program is evaluated and analyzed. A team of administrators, including the Curriculum Specialist for Science, confers with the principal and staff to establish the school's degree of program implementation. If the school does not meet all of the criteria, the principal and staff develop

an action plan which adjusts the program as needed. The Curriculum Specialist for Science visits each school monthly to confer with the principal and staff to monitor and provide assistance for the science program. *Reference Appendix #7, #8 and #9.*

G. SCIENCE CURRICULUM TESTING

BASIC SKILLS TESTS

1. Before implementation

   Prior to 1983 there was no formal evaluation or assessment of the district's science program.

2. After implementation, concurrent with the district goal to improve science, was a goal to administer Basic Skills Tests to all students. Teachers and administrators developed and field-tested the Basic Skills Tests with districtwide administration starting in May of 1984. The results are as follows:

	Science District Percentile		
Year	Grade 4	Grade 5	Grade 6
1983-84	58%	64%	58%
1984-85	72%	71%	71%
Growth	+14%	+ 7%	+13%

STEP TESTS

To measure the quality of the Washington School District's intermediate grade science program compared to national norms, the district administered the Addison Wesley's *Science Sequential Test of Educational Progress* (STEP) test to 300 randomly selected 6th grade students. The results of the tests are as follows:

Year	Science National Percentile Rank of Mean Standard - Score
1982-83	80%
1983-84	89%
1984-85	95%

3 year growth = + 15%

The test results have improved since the district goal to improve intermediate science has been implemented.

H. TIME ALLOTMENTS

1. Before implementation

   Traditionally the Washington School District has required 250 minutes of instruction in science/health per week.

2. After implementation

   The 250 minutes/week timelines are continuing in grades 4-5-6 with 50 percent of the time being designated for student laboratory experiences. Twenty percent of the total time is devoted to health. A current *Association for Supervision and Curriculum Development Journal* (ASCD) states the national average for 4th grade science is 140 minutes per week. The Washington School District provides almost twice the national average for 4th grade science. The Washington School District is in the top 5 percent of schools offering the greatest amount of science instruction. Other grades were not covered in the study.

I. SUPPORT

1. Staff — to provide direct support for the implementation of the intermediate science program the District provides (a) Instructional Assistants, who are teachers-on-assignment and aid the total staff in curriculum assessment and implementation; (b) Instructional Leaders, who are full-time science

teachers given the responsibilities of a Department Head; and (c) Curriculum Specialist for Science, who is a district-level administrator and aids the school principals and staff in the implementation and evaluation of their science program.

2. Materials — The district maintains science equipment in the warehouse along with paper and pencils and other standard materials. The teacher orders from the district catalog and will receive the shipment within 10 days. Automatic replacement of consumable material is provided for in the Silver Burdett Kits. *Health Activity Project* (H.A.P.) materials are automatically replaced at school request at the start of each school year. Each school maintains a standard list of capital outlay science equipment. *Reference Appendix #10.*

3. Inservice — The Washington School District cooperates with ASU to provide an ongoing system of teacher inservices. The inservice program has made it possible for the district to have the large number of highly trained staff who have a student activity-oriented approach to science instruction. These teachers work on curriculum development committees and have served as teaching examples for new teachers. The ASU classes has been taught on the Washington School District campus. They have been developed in concert with ASU, thus guaranteeing that content and methodology support the student (hands-on) activities and philosophy of the district. *Reference Appendix #11.*

   The Washington School District pioneered the Master's in Education with Emphasis in Science Degree at ASU. Forty teachers participated in this program. *Reference Appendix #12.*

   The Washington School District is currently offering an ASU certificate in science teaching which develops proficiency in science. *Reference Appendix #13.*

TABLE OF CONTENTS

Appendix 1-13

The following material is offered to add clarity to statements made in the report. Complete documents are available on request.

Appendix

1. *Standard operating procedures for the implementation of grades 4-6 Science* - each school uses the standard operating procedures to develop the minimum requirements for their 4-6 science program.

2. *Grade 4 Curriculum Assessment and Pacing Guide* - a Basic Skills Test question has been developed for each objective stated in the Curriculum Assessment Guide. The guide aids the teacher in keeping on task and provides the principal and District Curriculum Specialist for Science a method of monitoring the teacher's progress.

3. *Grade 4 Laboratory Curriculum Assessment and Pacing Guide* - a committee of teachers developed 70 activities which support the objectives covered by the Basic Skills Tests. Teachers are encouraged to expand on these minimum requirements to accommodate teacher and student's special interest.

4. *Sample activity from the 5th grade Laboratory Manual.*

5. *Health Activity Project sample worksheet from the 5th grade Laboratory Manual* - HAP is an activities oriented health program the Washington School District has implemented in grades 4-8. Based on problem solving and the scientific method, this program provides the students with numerous hands-on activities.

6. *Science Teacher Questionnaire* - 97% of the teachers responded to this questionnaire designed to establish their opinions about the effectiveness of their Science program.

7. *School and Program Reviews* - public information release.

8. *Science School Review Instrument* - this instrument is used to assess the strengths and weaknesses of the Science curriculum implementation.

9. *Program Review Checksheet* - the District Curriculum Specialist for Science confers with the principal and staff on a regular basis using this checksheet to monitor the school Science program.

10. *Standard Science Equipment list* - the 4-6 Science program incorporates the use of many supplemental teaching aids. A standardized list of capital expense items has been integrated into the curriculum. The District has coordinated our films and VCR material to the Science objectives. Standard Science teaching material is available through the District's warehouse, i.e., test tubes, beakers, and flasks.

11. *Summary of ASU/Washington School District Inservice Programs* - The number of teachers involved in the classes taught on the Washington School District campus provides the foundation for a sound Science program. To supplement the formal program, the District provides numerous other inservice experiences, i.e., Dairy Council Workshop, Arizona Mining Association Workshop, Game and Fish Department Workshops, and SRP Workshops.

12. *District notice describing the Masters of Arts degree with an emphasis in Science* - the Washington School District field tested this degree program for Arizona State University. Forty teachers initially became involved in this program. Science classes were conducted in the Washington School District.

13. *Certificate of Teacher Proficiency in Science* - this certificate is issued to teachers after completing a current program of instruction designed to improve teaching competencies in Science.

WASHINGTON SCHOOL DISTRICT
Academic Services

STANDARD OPERATIONAL PROCEDURES FOR IMPLEMENTING 4-6 SCIENCE PROGRAM

Staffing

Top priority should be given to staffing the science laboratory(s) with your most qualified teacher(s). The three staffing possibilities are:

1. One teacher teaching all intermediate sciences.
2. Two teachers teaching intermediate sciences.
3. One science teacher at each intermediate grade level.

Laboratory Availability

A minimum of one lab per school is required with two or three being available at larger schools when possible. The minimum time in the laboratory is 3 out of 6 periods. (20% of the science time allocations is for health.) A laboratory is defined as a classroom having 3 sink work stations and a teacher demonstration table with electricity and gas or butane.

Curriculum and Assessment (Content)

During the 1985-86 school year the science scope and sequence will be followed. The blue science assessment/pacing guides are available and should be utilized. The Evaluation of Basic Skills Test for science will be utilized with pupils in grades 4-6 to assist in monitoring pupil progress. Existing textbooks and supplemental materials will be available.

Curriculum and Assessment (Laboratory)

During the 1985-86 school year the blue laboratory assessment forms will be utilized to assist in monitoring pupil progress. Problem solving skills will be emphasized. A District produced booklet will serve as a laboratory activity guide for teachers to assist them in focusing on a core of required lab activities.

APPENDIX - 1

WASHINGTON SCHOOL DISTRICT

SCIENCE

GRADE 4

CURRICULUM ASSESSMENT
and
PACING GUIDE

1985 - 86

Directions: (Fill out one form per class)
At the end of each grading period the Principal will establish a date for the Curriculum Assessment and Pacing Guide to be submitted for evaluation.
The Teacher will date and initial each objective as it is completed. These objectives describe mastery expectations contained in the Science Program.

TEACHER _____ SCHOOL _____ CLASS _____

DATE	PRINCIPAL'S INITS.	COMMMENTS
_____	_____	_____
		_____
_____	_____	_____
		_____
_____	_____	_____
		_____
_____	_____	_____
		_____

Teacher's

During the end of October, January, March and May the Principal will establish a date for the Curriculum Assessment and Status Report to be submitted for his approval. The Teacher will date and initial each objective as it is completed. These objectives are a random sample and represent an overview of what is contained in the Science Program.

GRADE 4

	Date	Teacher's /Initial's
A. EARTH		
1. Characteristics of the Earth		
a. Identifies which layer of the earth can be most directly studied.		
b. Describes the forces that change the earth's crust.		
c. Describes the law of superposition.		
d. Describes slow changes in the earth's crust.		
2. Gases in the Air		
a. Identifies which two gases make up most of the earth's air.		
b. Identifies oxidation.		
c. Identifies the gas that combines easiest with other matter.		
d. Identifies the chemical used in fire extinguishers.		
3. Air and Flight		
a. Identifies how a rocket can fly beyond our atmosphere.		
b. Identifies the abbreviation for liquid oxygen.		
c. Identifies air pressure.		
d. Identifies the cross section of a wing which would provide the greatest amount of lift.		
B. HUMAN BODY		
1. Digestive System		
a. Identifies the location and function of the esophagus.		
b. Identifies what happens to food in the stomach.		
c. Identifies [illegible]		

d. Identifies where most of the digested food goes.		
2. Circulatory System		
a. Identifies oxygen as the gas found in greatest amount flowing from lungs to the capillaries.		
b. Identifies the organs of the circulatory system which contains the highest amount of oxygen.		
c. Identifies the function of the lungs.		
d. Identifies the relationship between heartbeat and exercise.		
3. Respiratory System		
a. Identifies what organ takes oxygen from the air.		
b. Identifies where the carbon dioxide you breath out comes from.		
c. Identifies what gas your body uses from the air after you breath in.		
d. Identifies how the oxygen you breathe gets into the blood.		
4. Skin, Skeletal, and Muscles		
a. Identifies the framework of the human body.		
b. Identifies the function of muscles.		
c. Identifies the function of the skin.		
d. Identifies how sweat controls body temperature.		
5. Nervous System		
a. Identifies the major parts of the nervous system.		
b. Identifies the part of the body that protects the spinal cord.		
c. Identifies the human sense organs.		
d. Identifies the relationship between the brain and the eye.		
C. HYDROSPHERE		
1. Water and Water Cycle		
a. Identifies the water cycle.		

b. Identifies the two processes that repeat during the water cycle.		
c. Identifies the states of the water.		
d. Identifies the characteristics of steam.		
D. MAGNETISM AND ELECTRICAL ENERGY		
1. Magnetism		
a. Identifies iron as the most common metal to be magnetized.		
b. Identifies the poles of a magnet.		
c. Identifies the relationship between north and south poles of a magnet.		
d. Identifies current electricity.		
2. Heat and Light Energy		
a. Identifies radiant and solar as two names used to identify energy from the sun.		
b. Identifies burning as a chemical change.		
c. Identifies that light can travel completely through some kinds of material.		
d. Identifies transparent material as material that can be seen through.		
E. ATMOSPHERE		
1. Weather and Climate		
a. Identifies the source of all earth's energy.		
b. Identifies the characteristics of warm and cold air masses.		
c. Identifies why air temperature changes.		
F. THE ENVIRONMENT		
1. Environment		
a. Identifies the meaning of the word environment.		
b. Identifies the best meaning for the word pollution.		
c. Identifies how plants affect the air.		
d. Identifies what is meant by fossil fuels.		

WASHINGTON SCHOOL DISTRICT

LABORATORY SCIENCE

GRADE 4

CURRICULUM ASSESSMENT and PACING GUIDE

Directions: (Fill out one form per class)
At the end of each grading period the Principal will establish a date for the Curriculum Assessment and Pacing Guide to be submitted for evaluation.
The Teacher will date and initial each objective as it is completed. These objectives describe mastery expectations contained in the Science Program.

TEACHER _____ SCHOOL _____ CLASS _____

DATE	PRINCIPAL'S INITS.	COMMENTS
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

	Date	Teacher's Initials
D. Skin, Skeletal, and Muscles		
28. How do humans produce carbon dioxide		
29. What is your body's framework?		
30. What are bones made of?		
31. How do muscles move bones?		
32. How do muscles and tendons move bones?		
33. How does sweat control your body temperature? (HAP)		
34. Does your body warm the air around you? (HAP)		
35. Which fabric makes the best "Heat Trap?"		
36. How do you change body temperature? (HAP)		
37. How does sweat help control your body temperature?		
38. How can you see with your fingers?		
E. Nervous System		
39. Do you react more quickly to light, to sound, or to touch? (HAP)		
40. Do all parts of the body have the same number of nerves?		
41. What can you do to change your eye/hand coordination performance time? (HAP)		
42. Are you training to reduce your reaction time? (HAP)		
III. HYDROSPHERE		
A. Water and the Water Cycle		
43. How does salt effect the condensation of water vapor?		
44. How long does it take to change solid water into liquid water?		
45. Do liquids change to a gas?		
46. Do all liquids evaporate at the same rate?		
IV. MAGNETISM AND ELECTRICAL ENERGY		
A. Magnetism		
47. What materials are magnetic?		
48. How can you show magnetic fields?		
49. Which poles attract and which poles repel?		
50. What is an electric circuit?		
51. What path does the electricity follow?		
52. What is a chemical change?		
53. Can light cause materials to burn?		
54. How do atoms work?		
B. Heat and Light Energy		
55. How does solar energy work?		
56. What is a use for radiant energy?		
57. Does light travel completely through some materials?		
58. Which color will keep the dog house warmer?		
59. How does color effect how light is reflected and absorbed?		
60. How does transparent and translucent glass work?		

4TH GRADE LABORATORY SCIENCE PACING GUIDE
FOR
UNDERSTANDING YOUR ENVIRONMENT

Introduction-Laboratory Skills (Material found preceding activities)

	Date	Teacher's Initials
1. Laboratory Safety Procedures		
2. Equipment Overview		
3. Metric Measurement Overview		
I. EARTH		
A. Characteristics of the Earth		
1. What are the layers of the earth?		
2. What causes the changes in the earth's crust?		
3. What effect do light and heavy rains have on soil?		
4. What is the Law of Superposition?		
5. Which layers of the earth are older?		
B. Gases in the Air		
6. How much of each gas makes up the air?		
7. How do gases combine in the air?		
8. How long does it take for iron to rust?		
9. Do candles require a constant supply of oxygen to burn?		
10. Why does water rise?		
11. Does air push on things?		
12. What is the effect of air pressure on a balloon?		
13. How can you show air has pressure?		
14. How are air pressure differences created on an aircraft wing?		
15. How do airplane wings work?		
16. How far does a paper rocket fly a straight line?		
17. How do jet boats work?		
II. HUMAN BODY		
A. Digestive System		
18. How does breaking down of food particles aid in digestion?		
19. Does saliva do more than soften food?		
20. What are the parts of the digestive system?		
21. Where are the digestive system parts located?		
22. How does the stomach work?		
B. Circulatory System		
23. What is your pulse rate?		
24. How does extra weight effect pulse rate?		
C. Respiratory System		
25. What do your lungs do?		
26. How does activity effect your breathing?		
27. How much air can your lungs hold?		

V. ATMOSPHERE	Date	Teacher's Initials
A. Weather and Climate		
61. What happens when ice meets warm air?		
62. What happens when cold air meets warm air?		
63. Which heats faster in sunlight, soil or water?		
VI. THE ENVIRONMENT		
A. Environment		
64. Who lives in our environment?		
65. What are fossil fuels?		
66. How are fossil fuels formed?		
67. Why do we recycle?		
68. Where is pollution?		
69. How does pollution effect habitat?		

SCIENCE

STUDENT_____
DATE_____
SECTION_____

ACTIVITY 44
GRADE 4

PROBLEM: How long does it take to change solid water into liquid water?

the GREAT ICE CUBE RACE

MATERIALS: 1 Plastic bag, 1 ice cube, 1 pencil
1 calibrated vial.

RULES:
1. You must stay in your seat; you have 5 minutes to melt your ice.
2. Your ice cube must remain in the plastic bag.
3. Any spilled or leaked water will not be measured.
4. After five minutes has passed, pour water from plastic bag in calibrated vial.

ANSWER THE QUESTIONS BELOW AFTER THE CONTEST:

1. How much water did you collect?_____
_____
_____

2. What energy sources did you use to melt your ice cube?_____
_____

3. How was energy transferred?_____
_____
_____

4. What will you do differently if there is another ice melting contest? Why?_____
_____
_____
_____

SCIENCE

STUDENT _____
DATE _____
SECTION _____

ACTIVITY 42
GRADE 4

HUBBARD

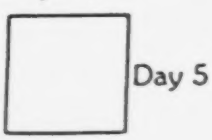
HAP SIDETRIP: Take-Home Reaction Timer. Ignore this section until the teacher asks you to work with it.

PROBLEM: Are you training to reduce your reaction time?

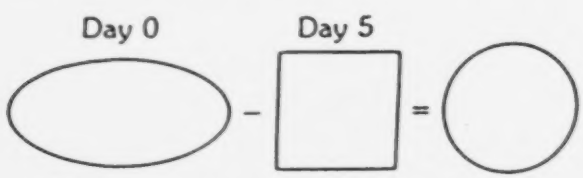
MATERIALS: HAP "Action-Reaction" Kit

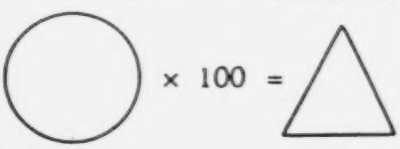
1. Conduct one trial before you start training, and record your before-training time in this oval.

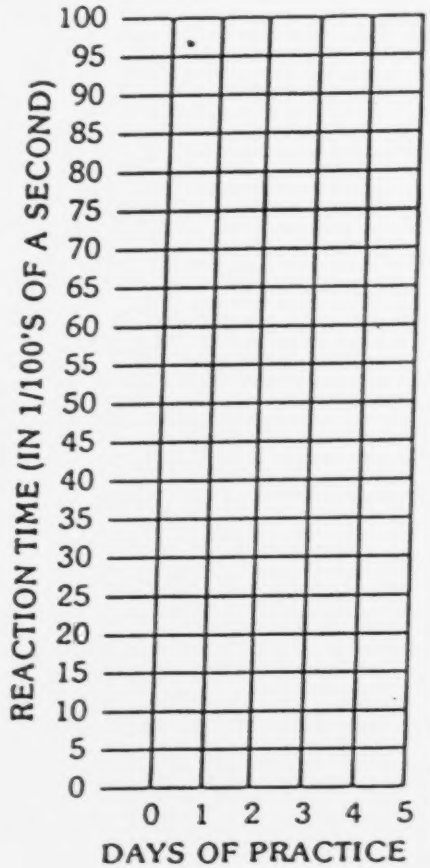
2. Use a small X to plot this time on the graph for Day 0, and draw a dotted line across the graph at that time.
3. Now conduct five trials a day for five days in a row, starting today if your teacher says you have time.
4. Plot the time for each trial on the graph. (You will have five X's for each day of practice.)
5. On the last day, average your five trials for that day, and record your average time in the square below. (Add the five numbers together and divide the total by 5.)



6. Calculate your *percent* improvement through these steps.







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WASHINGTON SCHOOL DISTRICT
Academic Services

Science Laboratory Questionnaire
Grades 4-6
Summary Results - End of Year
1984-85

1. Did you have a Science Fair (any grade level)?

1983-84	Yes	50%	No	50%
1984-85	Yes	63%	No	37%

Results: Science Fairs held increased by 13%.

2. Did you have an established 4-6 Laboratory Program which met District Standard Operating Procedures? (From the time your lab construction was completed.)

1983-84	Yes	9%	No	91%
1984-85	Yes	91%	No	9%

Results: 91% of 4-6 laboratory programs met District standards.

3. Estimate the number of laboratory activities a student would have completed last year (1983-84). 25 per class

Estimate the number of laboratory activities a student completed this year (1984-85). 59.8 per class

Results: Student laboratory activities completed increased by 133%.

4. How many college credits and District credits in Science and Science Methods do you have?

(Graduate and Undergraduate) 32.1 Semester Hours

Results: Average Science teacher possesses an Arizona teaching major in Science. State certification requires 30 semester hours for a teaching major.

5. Did you use the Blue Content and Laboratory Assessment Form?

1983-84	Yes	56%	No	44%
1984-85	Yes	100%	No	00

Results: Use of Blue Content and Laboratory Assessment Form increased by 44%.

6. Do you feel the quality of Science instruction improved with the Board emphasis on Science?

Yes 87% No 13%

Results: 87% of the teachers indicated that the quality of their Science program improved.

APPENDIX - 6

SCHOOL REVIEW PROCESS

Quality education in schools does not happen accidentally. It starts from the desire for improvement by teachers, students, parents, and administrators. The school review is a process involving the entire staff of the school and an external review committee in determining how well both the district's and school's objectives are being met.

Many aspects of the curriculum program and student services are appraised, including: reading, oral and written communication, mathematics, science, student activities, school and community relations, school planning, and library media center. Each year, approximately ten schools participate in the review process.

After the school review is conducted by both the staff and outside team, a summary report is developed. Based on the summary report, the principal works with the curriculum staff to develop a plan of implementation and then meets with the Assistant Superintendent for Administrative Services to develop a growth plan. All schools have been through the school review process at least once.

PROGRAM REVIEW PROCESS

The program review process is an ongoing, on-site curriculum evaluation plan. Members of the Academic Services division work cooperatively with principals and school staff to determine the effectiveness of curriculum programs, to provide support services, and to develop improvement plans, if necessary. Program review includes all content areas and special programs included in the educational programs of the Washington School District.

WASHINGTON DISTRICT SCHOOL REVIEW

Name of School_____ Principal_____

Area of Review SCIENCE/HEALTH (K - 6)

Date of Review_____ Check one:

Reviewers_____ School staff review ☐

On-site review ☐

This review form contains goals, objectives, or conditions which have been determined by the district to be important for the success of the school in meeting student needs.

After determining how well these objectives/conditions are being implemented, please circle yes or no when responding to the statements.

Materials developed by the Washington School District which assist in understanding district standards and expectations include:

1. Standard operating procedures for implementing 4-6 science.
2. Blue Content Assessment Form and Pacing Guide
3. Blue Laboratory Assessment Form and Pacing Guide
4. Health Scope and Sequence
5. Science Scope and Sequence
6. Standard Science Material List
7. Science and Health Instructional Leader Handbook

		Degree of Implementation	
A. PROGRAM/ASSESSMENT			
CRITERION: LABORATORY AND CONTENT FORMS ASSESS PROGRAM PROGRESS.			
Principal is current in using Content and Laboratory Assessment Forms and Pacing Guide to monitor the science curriculum			
	Grade K	YES	NO
	Grade 1	YES	NO
	Grade 2	YES	NO
	Grade 3	YES	NO
	Grade 4	YES	NO
	Grade 5	YES	NO
	Grade 6	YES	NO
B. INSTRUCTIONAL PROGRAM			
CRITERION: ALL COMPONENTS OF THE SCIENCE/HEALTH PROGRAM ARE IMPLEMENTED.			
1. Teachers are current in using teacher-directed instruction in the concepts found in the Content Assessment Form and Pacing Guide. . . .			
	Grade K	YES	NO
	Grade 1	YES	NO
	Grade 2	YES	NO
	Grade 3	YES	NO
	Grade 4	YES	NO
	Grade 5	YES	NO
	Grade 6	YES	NO
2. Teacher-directed "hands-on" activities as specified in the Laboratory Assessment Form and Pacing Guide are provided.			
a. Intermediate - Science		YES	NO
b. Intermediate - Health		YES	NO
3. Laboratory experiences are provided a minimum of three out of six periods.			
	Grade 4	YES	NO
	Grade 5	YES	NO
	Grade 6	YES	NO

	Degree of Implementation	
4. Teacher-directed instruction is provided in		
a. Vocabulary	YES	NO
b. Comprehension.	YES	NO
c. Writing.	YES	NO
5. District science staffing requirements are met .	YES	NO
6. District science materials requirements are met.	YES	NO
7. Supplemental materials are used as appropriate to student needs, i.e., films, health kits, energy kits, ESS, and OBIS	YES	NO
8. Teacher-directed instruction in the concepts found in the Health Scope and Sequence/Pacing Guide is provided.		
Grade K	YES	NO
Grade 1	YES	NO
Grade 2	YES	NO
Grade 3	YES	NO
Grade 4	YES	NO
Grade 5	YES	NO
Grade 6	YES	NO

WASHINGTON DISTRICT SCHOOL REVIEW

DEGREE OF IMPLEMENTATION
SCIENCE/HEALTH

1. Describe the strengths of this program.

2. Describe area(s) which do not meet district standards.

3. Describe any specific situations which need improvement.

4. List area(s) which could benefit from further development.

WASHINGTON SCHOOL DISTRICT
ACADEMIC SERVICES

SCIENCE

District Course of Study

A. Science Scope and Sequence and Pacing Guide is implemented and maintained.

B. Program objectives are established and disseminated.

C. Additional assessments have been utilized in planning for the science program.

Instructional Program

Test/Assessment

D. Analysis of Basic Skills Test is used in planning the science program.

E. Principal uses Assessment Form and Pacing Guide to assess the science curriculum grades 1-8.

Classroom/Grade/School Organization

F. Provides instructional time according to District standards.

G. Provides direct instruction in the concepts found in the science scope and sequence/pacing guide.

Materials & Supplies

H. District adopted textbooks are used K-6.

I. District adopted textbooks are used 7-8.

J. District approved supplementary material is used.

K. Non-print materials are used to teach Science.

L. Provides direct instruction in the concepts found in the health scope and sequence/pacing guide.

M. Involves students in science and health activities specified in the district scope and sequence/pacing guide (laboratory forms).

a. Primary - Science
b. Primary - Health
c. Intermediate - Science
d. Intermediate - Health
e. 7th and 8th Grades - Science
f. 7th and 8th Grades - Health.

Facilities/Equipment

N. District's science equipment standards are met.

O. Science lab instructional patterns meet District S.O.P.

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APPENDIX - 9

WASHINGTON SCHOOL DISTRICT
Academic Services

SUBJECT: Summary of Arizona State University Science Inservice Classes taught in the Washington School District

CLASS NUMBER AND TITLE		A. S. U. CREDIT HOURS	TEACHERS
1969			
PH 591	Topics in Physics for Elementary School Teachers	3	42
PH 591	Topics in Physics for Elementary School Teachers	3	28
PH 591	Topics in Physics for Elementary and Intermediate School Teachers	3	23
PH 591	Topics in Physics for Elementary and Intermediate School Teachers	3	18
BI 591	One Week Outdoor Education Seminar at Alpine	3	44
1970-73			
2EE 594	Individualization of Math and Science	3	21
IGL 475	Earth Science for Inservice Teachers	3	39
BI 591	Environmental Biology	3	41
BI 591	Outdoor Education Workshop in Alpine	3	33
PL 594	Metric System and Its Application in the Elementary Grades	2	27
2EE 591	Environmental Education Activities for Elementary Teachers	3	21
2EE 591	West Coast Oceanography Workshop	1	22
1974			
EE 591 & EE 594	SCIS/ESS Class	6	107
IPL 594	Course and Workshop Science Metrication	3	32
IPL 594	Course and Workshop Science Metrication	3	23
IPL 594	Course and Workshop Individualized Science Program	3	28
PL 594	Conference and Workshop in Science	3	21
PL 594	Conference and Workshop in Science	3	16
PL 594	Conference and Workshop in Science	3	9
PL 594	Conference and Workshop in Metrication	3	29
PL 594	Improving New Science Programs	3	31
PL 594	Special Topics: Metric Measurements	3	45
PLs 594	Special Topics: Metric Measurements	3	52
PL 594	Exploration and Development of ESS	3	13
EE 594	Workshop in Outdoor Education	3	26
PL 594	Science Through Student Involvement	6	64
1975			
PL 594	Metrics Portal Class	3	15
PSE 598	Metric Measurement	3	20
PL 591	Outdoor Education (Portal)	3	63
PSE 594	Conference and Workshop: Science Through Involvement	3	90
PHY 598	ST: Phy Elementary School Teachers	3	25
1976			
EED 594	Integrated Science, Math and Social Studies	6	67
PSE 594	Metric Education	3	9
PSE 594	Conference and Workshop Science Material	3	20
PSE 580	Practicum: Outdoor Education	3	20
PSE 598	Metric Education	3	28
PSE 594	Conference and Workshop - Science Materials	3	21
PSE 594	Metric Education	3	17
PSE 591	Astronomy for Teachers	3	25

CLASS NUMBER AND TITLE		A. S. U. CREDIT HOURS	TEACHERS
1977			
PSE 591	Portal Energy Program (Science)	3	36
PSE 591	Outdoor Education	1	50
PSE 598	Concepts of Energy and Matter	3	35
PSE 591	Portal Energy Program (Science)	3	40
1978			
EED 591	Programs and Strategies in Elementary Science and Outdoor Ed.	6	52
EE 591	S: Science, Health, and Outdoor Ed.	3	20
PSE 591	Portal Energy Program (Energy and Society)	3	20
EED 591	Elementary Science and Outdoor Education	3	19
1979			
EED 591	Primary School Language Arts and Science	6	33
PSE 594	Field Biology and Astronomy	3	27
GCU 594	Energy and Society	3	20
EED 594	Science Experiences for Primary Teachers	1	6
PSE 591	Energy Workshop	3	33
PSE 593	Energy and Society	3	17
1980			
PSE 593	Applied Project: Evaluation of Energy Curriculum	3	17
PSE 591	APS Energy Class (3 classes)	1	50
PSE 591	Portal Energy Program	3	36
1981			
PSE 591	Metrics	3	29
PSE 591	Portal Energy Program	3	35
PSE 591	Outdoor Education	1	46
1982			
PSE 591	Energy and Economics	3	25
PSE 591	APS Energy (4 classes)	1	55
1983			
PSE 591	Energy and Economics	3	18
EED 591	Science and the Outdoor Classroom	3	30
PSE 593	Health Curricula Implementation	3	17
PSE 593	Arizona Activities in Health (3 classes)	1	94
1984			
PSE 591S:	Science for Primary Teachers	1	13
PSE 594:	Physical Science Inservice	3	19
PSE 594	Arizona Activities in Health	1	19
1985			
PSE 593	Arizona Activities in Health	1	22

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STANDARD SCIENCE EQUIPMENT LIST FOR
4-6 SCIENCE PROGRAMS

1985-86

Grade 4 "Understanding Your Environment" Master Equipment Package
Grade 5 "Understanding Your Environment" Master Equipment Package
Grade 6 "Understanding Your Environment" Master Equipment Package

HAP MODULES AND ACTIVITIES

Grade 4 Skin Temperature Module and
Action-Reaction Module
Grade 5 Sight and Sound Module
Growth Trends Module
Grade 6 Heart Fitness Module and
Breathing Fitness Module

REPORT DATE 09/11/85

WASHINGTON SCHOOL DISTRICT #5
FURNITURE AND EQUIPMENT STANDARDS
FNEISOP - EQUIPMENT STANDARDS REPORT

CP COURSE NAME	COST	ASSET#	DESCRIPTION	K-6
2? SCIENCE	55	0135	AQUARIUM, 10 GAL	1/SCIENCE ROOM
2? SCIENCE	110	5708	BALANCE, HARVARD TRIP	2 PER SCHOOL
2? SCIENCE	63	5707	BALANCE, TRIPLE BEAM	4/SCIENCE ROOM
2? SCIENCE	385	4301	BIOSCOPE	1 PER SCHOOL
2? SCIENCE	39	5426	BLANKET, FIRE W/METAL BOX	1/SCIENCE ROOM
2? SCIENCE	105	2101	INCUBATOR, EGG & CULTURE	1 PER SCHOOL
2? SCIENCE	271	4303	MICROSCOPE, BINOCULAR	6 PER SCHOOL
2? SCIENCE	39	4305	MICROSCOPE, BLISTER	20 PER SCHOOL
2? SCIENCE	385	4306	MICROSCOPE, MONOCULAR COMPOUND	6 PER SCHOOL
2? SCIENCE	173	0104	MODEL, FISH	1 PER SCHOOL
2? SCIENCE	350	0102	MODEL, FROG	1 PER SCHOOL
2? SCIENCE	157	0103	MODEL, GRASSHOPPER	1 PER SCHOOL
2? SCIENCE	135	2001	MODEL, HUMAN EAR	1 PER SCHOOL
2? SCIENCE	165	2002	MODEL, HUMAN EYE	1 PER SCHOOL
2? SCIENCE	247	2003	MODEL, HUMAN HEART	1 PER SCHOOL
2? SCIENCE	77	2005	MODEL, HUMAN JAW	1 PER SCHOOL
2? SCIENCE	191	2007	MODEL, HUMAN SKIN	1 PER SCHOOL
2? SCIENCE	153	2008	MODEL, HUMAN TEETH	1 PER SCHOOL
2? SCIENCE	1,540	2004	MODEL, HUMAN TORSO	1 PER SCHOOL
2? SCIENCE	215	2006	MODEL, KIDNEY	1 PER SCHOOL
2? SCIENCE	150	4713	TABLE, SCIENCE, ACID TOP	16 PER LAB

APPENDIX - 11

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WASHINGTON SCHOOL DISTRICT
Program Development and Implementation

WASHINGTON SCHOOL DISTRICT/ARIZONA STATE UNIVERSITY

PROGRAMS IN

SCIENCE INSTRUCTION

Grades K-8

To: All Teachers Grades K-8 (Principals for Information)

The Washington School District in cooperation with Arizona State University is investigating the possibility of starting (in the Fall of 1982) a Masters of Education in Elementary Education Degree Program with an emphasis in Science. Other Science Education options will be offered to people not wishing a Masters.

These courses would be taught by A.S.U. Professors on the campuses of the Washington School District.

The benefits of this program are

... to provide enjoyable and relevant instruction,

... to increase your knowledge of science and health programs,

... to increase your professional growth and provide the security of flexibility,

... to increase your competence in teaching and assessing Science and Health curriculums.

Your response to this proposed program will give us sufficient information to proceed.

OPTIONS (see back of page for details)

1. Total Program - Masters in Elementary Education with emphasis in Science.

2. For those having a masters or interested only in the science courses...The University provides a Certificate of Completion (science emphasis) to those teachers completing a specified course of study...you would take all the science courses (18 hours) to be eligible for this Certificate.

3. If you are not interested in the total masters program but would like to enroll in some of the classes that are taught in the District please see reverse side.

All teachers responding to this note will be notified of the results of this questionnaire next September.

Please return the questionnaire on the back of this page to Dick Clark at the District Office by Tuesday, June 1, 1982.

Coordinator - Dick Clark, Phone: 995-6164
Washington School District

Advisor - Dr. Fred Staley, Phone: 965-3133
Arizona State University

WASHINGTON SCHOOL DISTRICT
Program Development and Implementation

Washington School District/Arizona State University
Program in Science Instruction Questionnaire

NAME _____ SCHOOL _____ GRADE _____

OPTIONS

( ) 1. Interested in total program...Masters in Elementary Education with emphasis in Science (total 30 hours - 12 Education, 18 Science

( ) 2. Interested in Certificate of Completion (Science emphasis) (will take all science classes...18 hours)

3. Interested in specific courses only (place x in box following course title).

Fall 1982

3 hrs PSE 594 Energy and Economics ( )
(this will be available tuition free and participants in the Masters program and Certificate of Completion program will be given priority.)

Spring 1983

3 hrs EED 594 Science in the Outdoor Classroom ( )

Summer 1983

6 hrs EED 594 Techniques for Implementing Current Science and Health Programs in the Washington School District ( )

Possible Future Science/Health Content Courses (6 hours from the following)

3 hrs Topics in Physics for Elementary Teachers ( )
3 hrs Environmental Biology ( )
3 hrs Science and Man ( )
3 hrs Health Educacion ( )

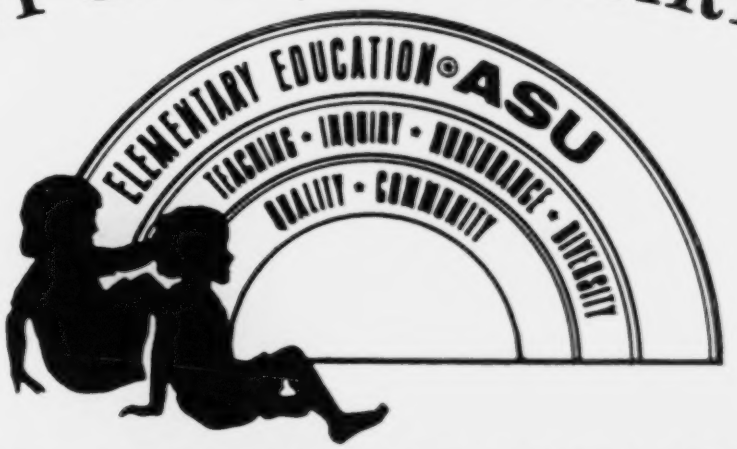
Basic Masters of Education Core Courses (12 credit hours)

(Courses in the following areas are required for teachers taking option 1 and periodically offered at A.S.U. Metro Center or A.S.U. Alhambra.

3 hrs 1. Curriculum Development (2 options)
3 hrs 2. Human Development and Learning (3 options)
3 hrs 3. Educational Foundations (4 options)
3 hrs 4. Research, Measurement, Evaluation (2 options)

RETURN TO DICK CLARK AT THE DISTRICT OFFICE BY JUNE 1, 1982

DEPARTMENT OF ELEMENTARY EDUCATION



COLLEGE OF EDUCATION
ARIZONA STATE UNIVERSITY

Presented to

_____

for completion of

A.S.U.-Washington School District

SCIENCE INSTITUTE

An eighteen semester-hour program for teacher proficiency in science.

_____
Dean, College of Education

_____
Date

_____
Chair, Department of Elementary Education